

CLAIMS

I claim:

1. A system for facilitating UPnP control of at least one non-UPnP device on one or more slave networks, the one or more slave networks including one or more different networking technologies, the system comprising:

a UPnP interface to at least one UPnP controller, the UPnP controller being configured to issue a UPnP command in conformance with a UPnP protocol, and

a UPnP proxy enabler that is configured to:

receive the UPnP command,

transform the UPnP command into a device command,

communicate the device command to a target device of the at least one non-UPnP device on the slave networks, and

communicate a UPnP acknowledgement of the UPnP command to the at least one UPnP controller, via the UPnP interface.

2. The system of claim 1, wherein the one or more different networking technologies include at least one of: a USB network, a bluetooth network, a HAVi-compatible network, an IEEE 1394 network, a Home API network, a HomeRF network, a Firefly network, a power line network, an X-10 network, and a Jini-compatible network.

3. The system of claim 1, wherein:

the UPnP controller is further configured to issue a UPnP request in conformance with the UPnP protocol,

the UPnP request includes one of: a description request, a presentation request, a subscription request, and a query, and

the UPnP proxy enabler is configured to provide at least one of: a device description, a service description, a presentation page, an event, and a value of a variable, in response to the UPnP request.

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4. The system of claim 1, wherein

the UPnP proxy enabler includes at least one of:

a discovery module that is configured to provide an advertisement of at least one non-UPnP device to the UPnP controller,

5 a description module that is configured to provide a description of functions of the at least one non-UPnP device to the UPnP controller, in response to a request from the UPnP controller, and

a presentation module that is configured to provide a presentation page that facilitates a control of the at least one non-UPnP device by a user.

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5. The system of claim 4, wherein

at least one of the discovery module, the description module, and the presentation module is configured to provide the advertisement, the description, and the presentation page, respectively, for the at least one non-UPnP device of the slave networks.

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6. The system of claim 1, wherein

the UPnP proxy enabler includes at least one of:

a device control module that communicates commands to the target device,

an event subscription module that receives requests from the at least one UPnP controller to be notified of one or more changes of state of the target device, and

20 an event source module that notifies the at least one UPnP controller of one or more changes of state of the target device.

7. The system of claim 6, wherein

25 the device control module maintains a service state table that reflects the state of the target device, and

the event source module notifies the at least one UPnP controller of the one or more changes of the state of the target device based on the service state table.

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8. The system of claim 1, wherein the UPnP proxy enabler communicates the device command to the target device by modifying a data structure that is associated with a thread, and the thread effects the communication to the at least one non-UPnP device of the slave networks.

5 9. The system of claim 1, wherein the UPnP proxy enabler is further configured to detect a connection and disconnection of the at least one non-UPnP device, and update one or more data structures associated with the slave networks accordingly.

10 10. The system of claim 9, wherein the UPnP proxy enabler is further configured to initiate and terminate threads based on the connection and disconnection of each of the at least one non-UPnP device.

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11. A method for facilitating UPnP control of at least one non-UPnP device on a non-IP slave network, comprising:

receiving a UPnP command in conformance with a UPnP protocol from a UPnP controller,

5 transforming the UPnP command into a device command,
 communicating the device command to a target device of the at least one non-UPnP device on the non-IP slave network, and
 communicating a UPnP acknowledgement of the UPnP command to the UPnP controller.

10 12. The method of claim 11, wherein the non-IP slave network is one of: a USB network, a bluetooth network, a HAVi-compatible network, an IEEE 1394 network, a Home API network, a HomeRF network, a Firefly network, a power line network, an X-10 network, and a Jini-compatible network.

15 13. The method of claim 11, further including:

receiving a UPnP request in conformance with the UPnP protocol,
 the UPnP request including one of: a description request, a presentation request, a subscription request, and a query, and

20 providing at least one of: a device description, a service description, a presentation page, an event, and a value of a variable, in response to the UPnP request.

14. The method of claim 11, further including at least one of:

providing an advertisement of at least one non-UPnP device to the UPnP controller,
 providing a description of functions of the at least one non-UPnP device to the UPnP

25 controller, in response to a request from the UPnP controller, and

providing a presentation page that facilitates a control of the at least one non-UPnP device by a user.

15. The method of claim 14, wherein

at least one of the advertisement, the description, and the presentation page are provided by a common UPnP proxy enabler for the non-IP slave network that is configured to provide advertisements, descriptions, and presentation pages for each non-UPnP device in the non-IP slave network.

16. The method of claim 11, further including

receiving requests from the UPnP controller to be notified of one or more changes of state of the at least one non-UPnP device, and

notifying the UPnP controller of one or more changes of state of the at least one non-UPnP device.

17. The method of claim 16, further including

maintaining a service state table that reflects the state of the target device, and notifying the UPnP controller of the one or more changes of the state of the at least one non-UPnP device based on the service state table.

18. The method of claim 11, further including

creating a thread that is associated with the at least one non-UPnP device of the slave network, and

modifying a data structure that is associated with the thread; and wherein the thread is configured to effect the communication of the device command to the at least one non-UPnP device of the slave network, based on the modification of the data structure.

19. A network comprising:
an IP sub-network,
a non-IP sub-network, and
a UPnP proxy enabler that facilitates communication and control between the IP sub-
5 network and the non-IP sub-network.

20. The network of claim 19, wherein
the UPnP proxy enabler is configured to:
receive a UPnP command from a UPnP controller on the IP sub-network,
10 transform the UPnP command into a device command, and
communicating the device command to a device on the non-IP sub-network.

21. The network of claim 19, wherein
the UPnP proxy enabler is further configured to provide at least one of: a device
15 description, a service description, a presentation page, an event, and a value of a variable
corresponding to the device on the non-IP network, in response to a UPnP request from the
UPnP controller on the IP sub-network.

22. The network of claim 19, wherein
20 the UPnP proxy enabler facilitates the communication and control between the IP sub-
network and the non-IP sub-network via the use of threads that provide a non-blocking
communication.

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